What is claimed:

1. A method of increasing the hardness of a steel object, comprising:

applying a nickel plating to at least a portion of a surface of the steel object;

subjecting the steel object to carburizing to allow carbon atoms to diffuse through the nickel plating and form a case portion at a depth greater than or equal to 0.012 inches; and

heat treating the steel object after said subjecting and the case portion having a hardness of at least Rc 50.

2. The method of claim 1, wherein the case portion having a hardness of at least Rc 50 at a depth up to about 0.090 inches.

3. The method of claim 1, wherein said applying includes an electroless nickel process.

4. The method of claim 1, which further includes removing the nickel plating.

5. The method of claim 1, wherein said heat treating includes annealing the steel object, and which further includes removing the nickel plating after said annealing and prior to further heat treating acts.

6. The method of claim 1, wherein said applying deposits the nickel plating having a thickness within a range of about 0.0005 inches to about 0.0025 inches.

7. The method of claim 6, wherein said applying deposits the nickel plating having a thickness within a range of about 0.0005 inches to about 0.0015 inches.

8. The method of claim 1, wherein the steel object is defined by stainless steel.

9. The method of claim 1, wherein in said subjecting the carburizing includes vacuum carburizing.

10. The method of claim 9, wherein the vacuum carburizing includes evacuating the carburizing atmosphere to a sub-atmospheric pressure, heating the steel object to the carburizing temperature, admitting carburizing gas into the carburizing atmosphere and drawing a further vacuum that begins with the admitting of carburizing gas into the carburizing atmosphere.

11. The method of claim 1, which further includes masking a portion of the steel object prior to said applying to prevent nickel plating on the portion of the steel object.

12. The method of claim 1, wherein the steel object is stainless steel;

wherein in said subjecting the carburizing includes vacuum carburizing;

wherein in said applying the nickel plating is an electroless nickel plating having a thickness within a range of about 0.0005 inches to about 0,0015 inches;

wherein said heat treating includes annealing the steel object; and

which further includes removing the nickel plating after said annealing and prior to any further heat treating acts.

13. The method of claim 12, wherein in said subjecting the carburizing occurring at a carburizing temperature above ambient temperature, and wherein the nickel plating can withstand the carburizing temperature without melting.

14. The method of claim 13, wherein the nickel plating is a deposition alloy of about 96 to about 98 nickel and about 2 to 4 percent phosphorous by weight percent.

15. A method of processing a steel object, comprising:

plating a surface of the steel object with an electroless nickel material;

heating the steel object to a carburizing temperature;

subjecting the steel object to carburizing wherein carbon atoms diffuse through the plating and form a hardened case region; and

removing at least a portion of the electroless nickel material after said subjecting.

16. The method of claim 15, which further includes performing post thermal operations after said removing.

17. The method of claim 15, which further includes annealing the steel object after said subjecting, and which further includes performing post thermal cycles after said annealing.

18. The method of claim 15, wherein said plating deposits the electroless nickel material to a thickness within a range of about 0.0005 inches to about 0.0025 inches.

19. The method of claim 15, wherein the steel object is a stainless steel;

wherein said plating results in a substantially uniform coating having a thickness with a range of about 0.0005 inches to about 0.0015 inches;

which further includes annealing the steel object after said subjecting;

which further includes hardening the steel object after said annealing;

which further includes stabilizing the steel object after said hardening;and

which further includes tempering the steel object after said stabilizing.

20. The method of claim 19, wherein the hardened case region having a hardness of at least Rc 50 at a depth greater than or equal to 0.012 inches.

21. The method of claim 19, wherein the hardened case region having a hardness of at least Rc 50 at a depth greater than or equal to 0.012 inches and up to about 0.090 inches.

22. The method of claim 20, wherein in said subjecting the carburizing occurring at a carburizing temperature above ambient temperature, and wherein the nickel plating can withstand the carburizing temperature without melting.

23. The method of claim 22, wherein the nickel plating is a deposition alloy of about 96 to about 98 nickel and about 2 to 4 percent phosphorous by weight percent, and wherein the carburizing is a vacuum carburizing.

24. The method of claim 15, which includes changing the carbide structure within the hardened case region by adjusting the thickness of said plating;

25. The method of claim 15, wherein said plating includes selecting the thickness of the nickel material to select the carbide formation in the case region.

26. The method of claim 15, which further includes controlling the thickness in said plating to control the formation of carbides in the case region, and wherein the steel object is formed of stainless steel.

27. A method comprising:

(a) applying an electroless nickel plating to a surface of a stainless steel object;

(b) placing the object within a mechanical housing;

(c) evacuating the environment within the mechanical housing to a sub-atmospheric pressure;

(d) heating the object within the mechanical housing to a carburizing temperature;

(e) introducing a carburizing gas into the mechanical housing for a first period of time;

(f) drawing a vacuum within the mechanical housing for a second period of time; and

(g) repeating acts (c) – (f) a plurality of times.

28. The method of claim 27, which further includes removing at least a portion of the nickel plating after said repeating.

29. The method of claim 27, which further includes removing the nickel plating after said repeating.

30. The method of claim 27, which further includes a post carburizing passive diffusion act after said repeating to enable the carbon atoms to diffuse further into the object.

31. The method of claim 30, wherein said drawing commencing upon the beginning of said introducing act.

32. The method of claim 27 which further includes annealing the object after act (g);

which further includes removing the nickel plating after said annealing;

which further includes hardening the object after said annealing;

which further includes cooling the object to a temperature below room temperature after said hardening; and

which further includes tempering the object after said cooling.

33. The method of claim 32, wherein said applying deposits the nickel plating having a thickness within a range of about 0.0005 inches to about 0.0015 inches, and

wherein the steel object having a hardened case region with a hardness of at least Rc 50 at a depth greater than or equal to about 0.012 inches.

34. The method of claim 33, wherein the steel object having a hardened case region with a hardness of at least Rc 50 at a depth up to about 0.090 inches.

35. The method of claim 27, wherein said heating to a temperature within a range of about 1600 °F to about 1700 °F;

wherein said applying deposits a uniform nickel coating having a thickness within a range of about 0.0005 inches to about 0.0025 inches;

wherein said evacuating to a sub-atmospheric of about 1 torr;

wherein in said introducing the first period of time is about one minute;

wherein in said drawing the second period of time is about four minutes, and wherein said second period of time commencing when said introducing begins;

wherein said repeating occurring for 520 times.

36. The method of claim 27, wherein the nickel plating is a deposition alloy of about 96 to about 98 nickel and about 2 to 4 percent phosphorous by weight percent, and wherein the carburizing temperature is below the melting point of the nickel plating.

37. The method of claim 27, which includes adjusting the desired carbide structure within the hardened case region by adjusting the thickness of the plating..

38. The method of claim 27, which further includes controlling the thickness of the nickel plating to control the formation of carbides in the case region.

39. An apparatus comprising:

a steel body having a hardened carburized case portion and a core portion, wherein said case portion has a hardness of at least Rc 50 and is substantially free of continuous phase grain boundary carbides.

40. The apparatus of claim 39, wherein the steel body is formed of a stainless steel.

41. The apparatus of claim 40, wherein said stainless steel having a nominal chemical composition in weight percent of chromium (Cr) 13%; nickel (Ni) 2.85%; molybdenum (Mo) 1.8%; cobalt (Co) 5.3%; magnanese (Mn) 0.7%; vanadium (V) 0.6%; and the balance iron (Fe).

42. The apparatus of claim 39, wherein the case portion has a hardness of Rc 50 to a depth greater than or equal to 0.012 inches.

43. The apparatus of claim 39, wherein the case portion has a hardness of Rc 50 to a depth up to about 0.090 inches.

44. The apparatus of claim 39, wherein said case portion includes fine uniformly dispersed carbides.

45. The apparatus of claim 39, wherein said steel body is formed of a stainless steel having a nominal chemical composition in weight percent of chromium (Cr) 13%; nickel (Ni) 2.85%; molybdenum (Mo) 1.8%; cobalt (Co) 5.3%; magnanese (Mn) 0.7%; vanadium (V) 0.6%; and the balance iron (Fe); and

wherein said case portion has a hardness profile substantially as set forth in Fig. 6.

46. The apparatus of claim 45, wherein the steel body forming one of a gear and a component of a rolling element bearing.

47. The apparatus of claim 39, wherein the steel object is a stainless steel and wherein the corrosion resistance of the stainless steel has not been substantially degraded in the carburized case portion.

48. An apparatus comprising:

a stainless steel body having a hardened carburized case having a depth greater than or equal to 0.012 inches and a hardness greater than Rc 60.

49. The apparatus of claim 48, wherein the stainless steel having a nominal chemical composition in weight percent of chromium (Cr) 13%; nickel (Ni) 2.85%;

molybdenum (Mo) 1.8%; cobalt (Co) 5.3%; magnanese (Mn) 0.7%; vanadium (V) 0.6%; and the balance iron (Fe); and

wherein said case has a hardness profile substantially as set forth in Fig. 6.

50. The apparatus of claim 48, wherein the case has a hardness of at least Rc 50 to a depth up to about 0.090 inches.

51. The apparatus of claim 48, wherein the corrosion resistance of the stainless steel has not been substantially degraded in the hardened carburized case.